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A PILOT DEMONSTRATION PROJECT OF
TECHNOLOGY APPLICATION FROM THE
AEROSPACE INDUSTRY TO CITY MANAGE-
MENT (FOUR CITIES PROGRAM)

George F. Ervin, et al

Jet Propulsion Laboratory

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CIVIL
SYSTEMS
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Task 154
Nov. 13, 1972

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FIRST ANNUAL REPORT
A PILOT DEMONSTRATION PROJECT
OF TECHNOLOGY APPLICATION
FROM THE AEROSPACE INDUSTRY TO
CITY MANAGEMENT
(FOUR CITIES PROGRAM)

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PASADENA, CALIFORNIA

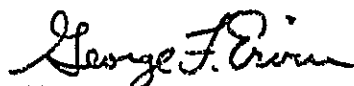
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-ii-

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ABSTRACT

The NSF/NASA joint program "A Pilot Demonstration Project of Technology Application from the Aerospace Industry to City Management," commonly termed the "Four Cities Program," has completed the first year of the planned two-year program. At the beginning of this first year a variety of program initiation activities were accomplished. Contracts were negotiated; science and technology advisors were interviewed, selected and assigned; general indoctrination and integration of the advisors into city affairs occurred; technical needs were identified and related projects pursued; pilot projects for the second year were identified; inter-city coordination on technical problems began to emerge; and the general soundness of the 4 Cities Program seems to have been established. Above all, the inter-personal relationships between the advisors and their interfaces in city government appear to be functioning smoothly. The establishment of such mutual respect, trusts, and confidences are believed essential to the success of the program.

SECTION I

OBJECTIVES

A. GENERAL OBJECTIVES

The general objectives of the project are those provided in NSF guidelines for intergovernmental science programs. These objectives are:

- 1) To advance the understanding of public issues and problems having scientific and technological content at the State and local levels of government and to assess needs and opportunities for more effective application of science and technology.
- 2) To demonstrate innovative science and technology planning and decision-making processes related to State, local, and regional problems.
- 3) To stimulate selected State and local governments' experimentation, on a pilot basis, with science and technology systems in the context of their own needs and resources.
- 4) To encourage adoption of new systems which show promise for enhancing State and local ability to incorporate science and technology into public programs.
- 5) To improve communication between persons and groups concerned with science and technology at the Federal, State, and local levels of government.

B. SPECIFIC OBJECTIVES

The specific objectives of the Four-Cities project provide a number of different opportunities, each partially meeting the five NSF program objectives stated above. The specific objectives are to conduct a pilot demonstration project wherein senior industrial aerospace professionals are placed in high-level positions in City government to:

- 1) Determine the ability of industrial aerospace professional to contribute directly in the environment of the cities at this level.
- 2) Determine the nature and amount of technical support required to implement a program to bring aerospace technology to local governments.
- 3) Expose City personnel to the "systems approach" and thereby enhance their performance through this educational process.
- 4) Expose aerospace personnel to the socio-political process in the cities to enhance their understanding of the cities' problems.
- 5) Assess the applicability of aerospace technology and expertise to problems of the cities.
- 6) Evaluate whether or not this type of arrangement is beneficial to the cities and to the aerospace industrial community.

SECTION II

APPROACH

The pilot demonstration project requires the direct support and backing of various organizations and agencies as follows:

- 1) Each of four California aerospace corporations is providing one professional in residence with a local government and will provide back-up technical support of one man-year equivalent per year to that professional for the duration of the project (two years).
- 2) Each of four California cities is providing office space and services and will make available to the assigned professional some percentage of the time of the City Manager and the various departments' personnel for discussions and assistance.
- 3) The Jet Propulsion Laboratory is providing project planning and evaluation, coordination, technical monitoring, and technical backup assistance to personnel from all four cities. The JPL supporting effort will be the equivalent of three man-years per year for two years.
- 4) The NASA Technology Applications Office (TAO) is providing funding to JPL for the JPL effort as part of its agreement with the Civil Systems Program Office of JPL.
- 5) The National Science Foundation is providing funding to pay the salaries, fringe benefits, and relocation and travel expenses for the four aerospace professionals from industry.

A. MODE OF OPERATION

Each city selected has been paired with an aerospace corporation. Maximum utilization has been made of prior interests and relationships between cities and corporations. The professional assigned to report to the City Manager or to his designee is considered, in effect, as being on the staff of the City Manager. The City Manager or his designee has provided personal support and provided

the necessary introductions to each of his various department heads and to the remainder of his staff.

Candidates for these professional positions have been nominated by their parent organizations. The paired City Manager and the JPL Principal Investigator have both interviewed the candidates and the City Manager made the final selection. The primary qualifications required of the professional were:

- 1) Experience of from eight to 15 years in aerospace, preferably with most of the experience in his present organization.
- 2) Project (or hardware) systems orientation and experience.
- 3) Good communications and presentation skills.
- 4) Strong personal motivation to assist in solving urban problems.

The aerospace professional reports functionally and receives his directions from the cognizant City Manager. An orientation period of from three to six months (at the discretion of the City) occurred wherein the aerospace personnel were introduced to and became acquainted with the City's organization and personnel. Following this period, the aerospace professional was either assigned to a particular department of the City, given specific ad hoc responsibility, or continued to provide broad technical support. As specific problems were defined, he sought ad hoc backup assistance from his parent industrial organization or from JPL to enhance both his performance and the potential for programmatic success.

B. REVIEW AND REPORTING

Evaluation meetings involving all City Managers (or their designees), all four professionals and representatives of their parent organizations, and JPL cognizant personnel are held quarterly to assess the status, identify common problems, and review the performance of the project. Representatives from NSF and NASA are invited to attend to compare inputs from similar programs in other states.

The existing monthly reporting system used by JPL to report progress to NASA is utilized. The annual letter report required by NSF will be provided by JPL, as well as both an informal report after the first year of the project and a formal report at the conclusion of the project to NASA, NSF, and the participating cities and organizations.

SECTION III

PROGRAM ACTIVITIES

A. CITY/CORPORATION PAIRINGS

The original JPL proposal to the NSF and to the NASA (JPL document 650-127, dated 22 February 1971) proposed the pairings shown in Table 1.

Table 1. Pairings as originally proposed

City	Corporation
Anaheim	NARISCO (North American Rockwell)
Fresno	TRW Systems
Pasadena	(To be determined)
San Jose	LMSC

In March 1971 the Envirogenics Company (a Division of Aerojet-General Corporation) was paired with Pasadena. In June 1971, the Aerojet-General Corporation reassigned this program effort from the Envirogenics Company to the Space-General Division of Aerojet-General, due to change in personnel assignments. In October 1971, NARISCO and JPL agreed to terminate further negotiations, and NARISCO agreed to contribute the services of the resident aerospace professional through December 1971. The Northrop Corporation was then paired with Anaheim and the pairings as they existed as of January 1972 are shown in Table 2.

In June of 1972 TRW Systems notified JPL of their desire not to contract for the second year effort. The reasons revolved around the personal interests of the advisor that was currently assigned to Fresno as well as the longer range business objectives of TRW Systems. A Request for Proposals was sent out by JPL to cover the second-year Fresno effort and in September 1972 a contract

Table 2. Pairings as of January, 1972

City	Corporation
Anaheim	Northrop
Fresno	TRW Systems
Pasadena	Space-General
San Jose	LMSC

was executed with La Jolla Research and Business Associates (LJR), a wholly-owned subsidiary of Science Applications, Incorporated of La Jolla, California. The pairings as of September 1972 and current as of this date are as shown in Table 3.

Table 3. Pairings as of September, 1972

City	Corporation
Anaheim	Northrop
Fresno	La Jolla Research (LJR)
Pasadena	Space-General
San Jose	LMSC

B. REVIEW/SELECTION OF ADVISORS

The selection of the Science and Technology Advisors was a cooperative effort among the respective city manager and his staff, the respective parent organization and members of the Jet Propulsion Laboratory (JPL). Several technical personnel* were interviewed by both the city manager and his staff and members of the JPL. The selection was based on a rating of the individuals' technical background, organizational ability, objectivity, seniority of position

*TRW Systems nominated only one candidate; however, he was acceptable to the City of Fresno and JPL.

with the industry and the ability to get along with people at all levels. The Advisor selected for in-residence duty at each city hall respectively, was:

- 1) Mr. Jerome Weiss (LMSC) - San Jose.
- 2) Mr. Forrest Warren (Space-General) - Pasadena.
- 3) Mr. William Armstrong (Northrop) - Anaheim.
- 4) Mr. James Wakeman (TRW) - Fresno (1st year).
- 5) Mr. Michael Licciardello (LJR) - Fresno (2nd year).

C. QUARTERLY REVIEW MEETINGS

To date there have been five meetings of the participants including an Initiation Meeting and four Quarterly Reviews. The Initiation Meeting was held at JPL on June 24-25, 1971. The First Quarterly Review was held at JPL on November 12, 1971; the Second Quarterly Review at Fresno on February 18, 1972; the Third Quarterly Review at Pasadena on May 19, 1972; the Fourth Quarterly Review at San Jose on September 15, 1972.

1. Initiation Meeting

A summary of space technology applications efforts at JPL was presented followed by a summary of aerospace experience in the civil systems sector from each of the potential contractors. The second day was a summary of city technical problems and organizations presented by each city representative.

2. First Quarterly Meeting

A review of the program objectives and plan was presented by JPL. Status reports were then given by the four cities with a pre-suggested theme of suggested topics including first impressions, methods for increasing or improving communications, identifying specific and general problems, accomplishments, and a plan for accomplishing specific objectives. (For details, see the minutes of the First Quarterly Meeting.)

3. Second Quarterly Meeting

A review of the program plan and JPL support was presented by JPL followed by a status report from each city. The status reports were directed toward identifying city problems, the approach to these problems, and their time scale, which was based on the Advisor's assignments from the City Manager. A discussion centered around correlating the Advisor assignments to candidate projects were to be discussed in the Third Quarterly Review. (For details, see minutes of Second Quarterly Meeting.)

4. Third Quarterly Meeting

Following introductory remarks by the joint sponsors JPL presented a program status report and a review of JPL support. Status reports were then given by each city. The theme of this review was the identification and discussion of candidate projects to be pursued by each city. General requirements and selection criteria were also discussed. (For details see minutes of Third Quarterly Meeting.)

5. Fourth Quarterly Meeting

Introductory remarks were made by program sponsors and several new personnel changes were described. A review of the program plan and status was given by JPL followed by a status review by each city. The afternoon was spent in a roundtable discussion of "How can we increase the effectiveness of the Four Cities Program?" (For details see minutes of the Fourth Quarterly Meeting.)

D. DEFINITION OF PILOT PROJECTS

In order to meet the general objectives of the Four-Cities Program,* a major pilot project is to be undertaken in each city. The pilot projects were to be selected by the cities from several candidate pilot projects which relate to

*As stated in "Proposal for a Pilot Demonstration Project of Technology Application from the Aerospace Industry to City Management," JPL 650-127, Feb. 22, 1971.

one or more of the general objectives of the program. As such, a candidate project may (1) provide a major change for improvement of some condition of the local population, (2) improve or enhance city administration, or (3) introduce a new operation or capability to the city. The selection criteria and its rationale, ordering of candidate projects, and the selection itself are the responsibilities of the City/Advisor.

The pilot projects which have been selected by the cities are identified below. In many cases, this merely represents the current top priority item from a list of projects which a city would like to pursue:

- 1) Anaheim - Cable Television (CATV).
- 2) Pasadena - Management by Objectives.
- 3) San Jose - Municipal Information Systems.
- 4) Fresno - Solid Waste Disposal. (Tentative.)

E. BACKUP SUPPORT PROVIDED BY NASA/JPL

Much of the support provided by JPL has been in the area of program coordination and in the dissemination of information of common interest to all cities. Specific support activities are identified below.

1. Anaheim

The support given by NASA/JPL included discussions and a suggested methodology with the Anaheim Police Department regarding police helicopter effectiveness. JPL suggested that a trend analysis of helicopter data (flight logs) be used and only crimes of robbery and burglary be considered.

A JPL consultant was used to aid the Advisor in reviewing the cable television (CATV) system and proposed City ordinance. The consultant wrote the specifications for the CATV system based on the needs of the different departments. This led to revising and updating the proposed ordinance. The consultant has assisted the Advisor at bidders conferences. JPL also furnished support to the CATV effort by providing consultation relative to Source Evaluation Board procedures.

Anaheim's interest in obtaining and operationally deploying infrared imaging devices within the fire and police departments is currently being supported by JPL. This is being done by the development of a plan in which JPL will procure the devices and distribute them in a sequential fashion to all of the cities of the Four Cities Program as well as the City of Tacoma, Washington. This plan is currently in the proposal stage and implementation is awaiting approval and funding.

2. Fresno

Meetings have taken place between JPL and Mr. C. Ware, Assistant Director of the Department of Public Works, regarding solid waste disposal. As a result the city of Fresno is interested in pyrolysis of solid wastes. JPL participated in the identification of the decisions that must be made; i.e., separation size, pyrolysis furnace, products, markets, and disposal of unwanted materials.

A seminar was initiated at JPL to exchange information with the Fresno Community Analysis Division. The subject was modeling and was beneficial to all concerned. A model for equipment replacement written by Mr. Ware was programmed by JPL on the Univac 1108 and transferred to Fresno's RCA Spectra 70/135 computer and checked out. Continuing activity with this model and distribution to other cities is subject to release by Fresno pending an examination of copyright considerations.

3. Pasadena

NASA/JPL support included helicopter-site noise measurements at a potential location for use by the Advisor and the City of Pasadena in selecting a landing site for their Police helicopter operations can be increased significantly through the use of a heliport located within Pasadena city limits. JPL used two different sound level meters to make on-site noise measurements and conducted an objective evaluation. Results indicated that the noise level was not in excess of ordinary traffic noise expected in the near future from freeways planned for the same area.

4. San Jose

The primary support to San Jose has been in the interchange of information.

The utilization of JPL consultation support in the examination of cost/benefit trades relative to computer data systems is being considered.

F. OVERALL PROGRAM SCHEDULE

The overall program schedule shown in Fig. 1 includes the reporting requirements for each aerospace organization. The out-of-phase negotiations and signing of the contracts have precluded an altogether standard schedule. Adjustments have been made to the reporting schedule to obtain reasonable consistency between all of the organizations. .

G. PROGRAM FINANCIAL DATA

NASA and NSF financial data for FY 1972 is as follows:

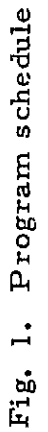
1. Obligations

NSF (Advisors)	\$138,874
NASA	<u>64,864</u>
	\$203,738

2. Incurred Costs

NSF (Advisors)	\$100,537
NASA	<u>63,228</u>
	\$163,765

Total program cost estimates to completion, including FY 1972, FY 1973, and FY 1974 are shown in Fig. 2. The NSF costs and obligations are associated directly with the contracts to the four aerospace organizations.



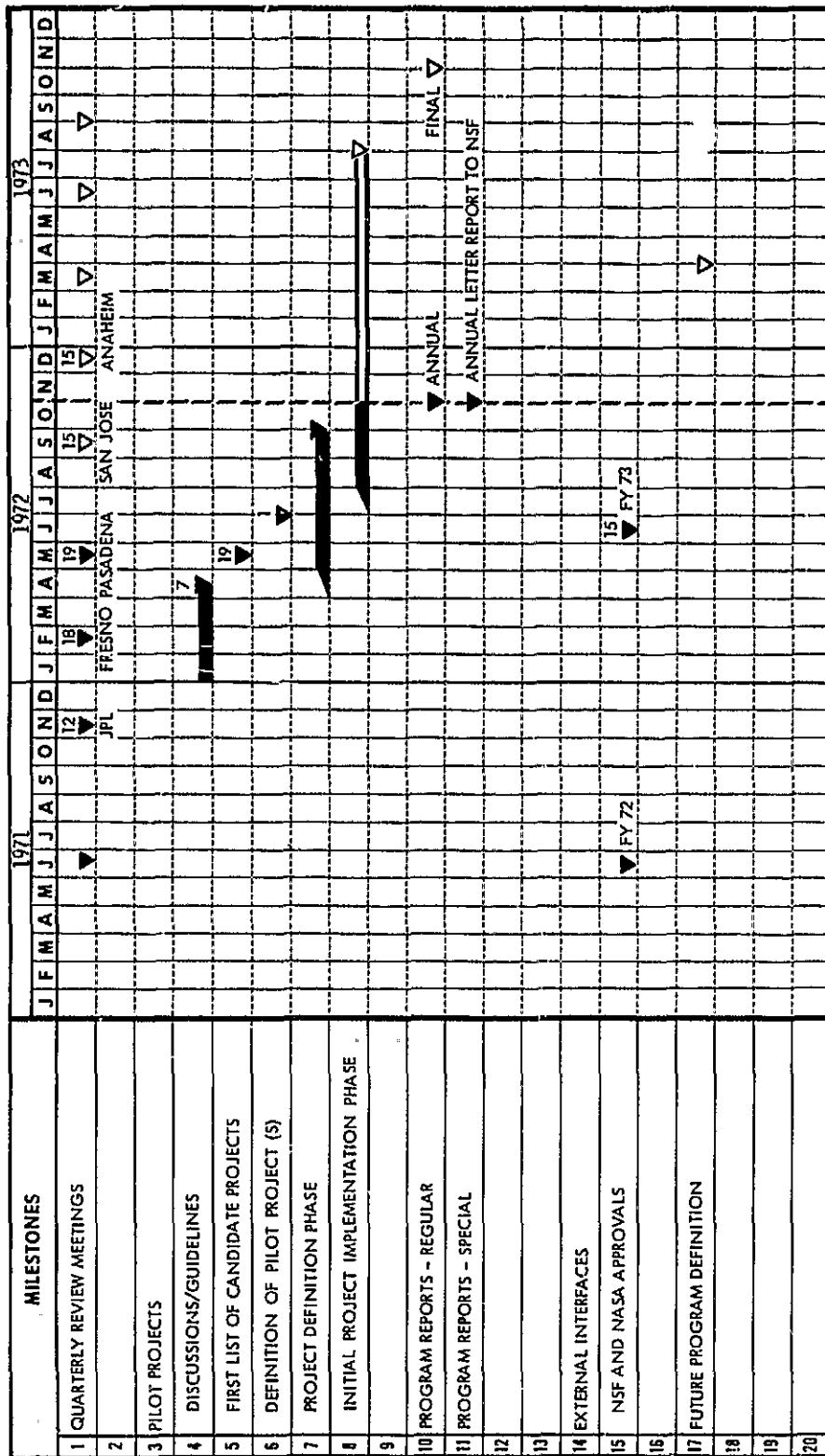
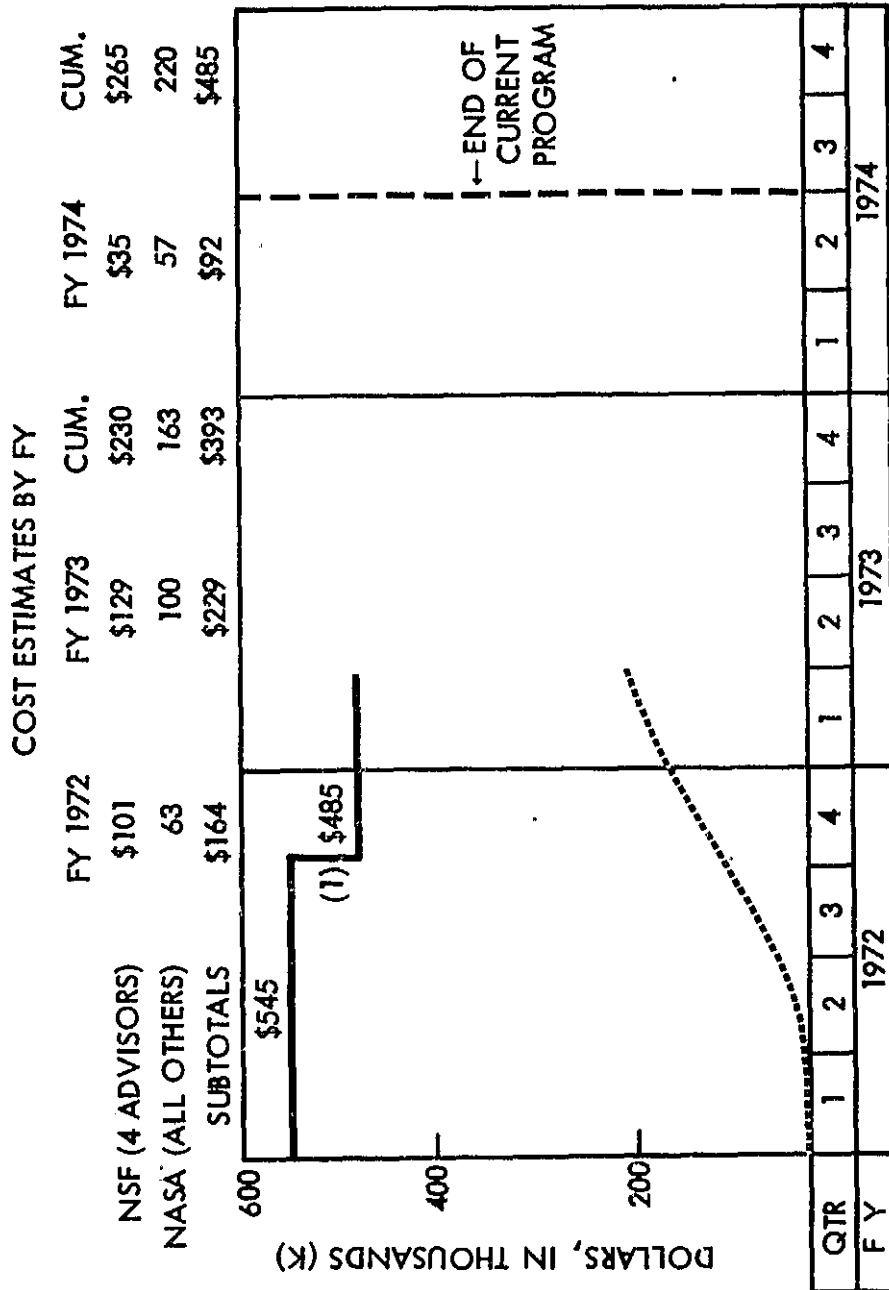


Fig. 1 (Contd)



(1) NASA DIRECTION

— ESTIMATED COST AT COMPLETION

..... COST INCURRED FROM INCEPTION

Fig. 2. Program cost estimate to completion

SECTION IV

ACTIVITIES BY EACH ADVISOR AND RELATED ACTIVITIES FOR EACH CITY

The activities of each advisor and the related activities of each respective city are given in this section.

A. ANAHEIM/NORTHROP

The effort contractually has entered the third quarter of an Advisor working in residence at the City of Anaheim; however, activities of an acting Advisor were funded by NARISCO* and a consultant funded by NASA/JPL.

During the first quarter and from preceding activities, the cable TV (CATV) system (called Anaheim Cable Communications Systems) proposed for the City of Anaheim led to a revision of their city ordinance. The specifications associated with the new ordinance were written according to the needs of the departments. Included are video/FM/data reception, video/data transmission, closed circuit two-way television, and emergency-disaster override to various municipal installations. There would also be cable TV in the schools and hospitals. This stemmed from previously identified problems of public communication, city communications equipment, internal communications, data management, and fiscal planning.

The Advisor has also been assigned to devote specific attention to an integrated City command and control center. Specific functional and design requirements were identified to initiate activity in this area.

In addition, other activities of the initial quarter were (1) setting up a program control system with a display supplied to the City Manager's office, (2) initiating support from Northrop concerning smoke removal or viewing through

*Mr. John Glasscock of NARISCO contributed significantly to the development of the CATV specification.

smoke, and (3) providing information on handling of trash for the Parks and Recreation Department.

At the end of the first quarter, specific objectives were agreed to between the Advisor and the City Manager of Anaheim. These included continuing support of the City's Cable Television franchising activity, and plans for integration of City communication systems as well as seeking programs involving the following:

- 1) Support from the parent company.
- 2) Funding of some new technology applied to City problems.
- 3) Cost savings to the City.

In the ensuing period the Advisor assumed technical responsibility of all aspects of the proposed cable franchise and planned and coordinated meetings with prospective franchisees leading to solicitation of bids.

In addition, as a member of a City Communications Steering Committee, the Advisor recommended consolidation of public safety (Police and Fire Department) communication functions and prepared a specification to implement a new facility and supporting ancillary command and control equipment.

The project addressing the problem of smoke during fire suppression operations has led to the identification of hand-held infrared viewing equipment and demonstration of this equipment in a test fire at an abandoned building. As a result of this activity a proposal will be tendered to the National Science Foundation to test the equipment in operational use and further demonstrations are planned in Huntington Beach, California and Tacoma, Washington.

In an advisory role to the City's Data Processing Steering Committee, recommendations from the parent company have been incorporated into an overall approach to the Master Plan for the operation of the City's Data Processing organization.

B. FRESNO/TRW SYSTEMS

Activities during the first quarter of the program centered around technical consulting activities, becoming familiar with city operations, and long-range program activities. Contacts were made with all of the departments. Nature of the problems ranged from breathing-apparatus development for the Fire Department to sewage disposal problems caused by the wine industry in Fresno. The technical consulting activities consisted of providing services to the various departments on technical matters such as odor measurement and its control and abatement, LPG conversion of fleet vehicles, and bicycle path planning. The long-range activities have focused on environmental impact statements on city administered land-use programs which make use of state or federal funds. A second major function was to establish a citizens' Environmental Quality Council with the overall purpose being to improve the awareness of the city administration to current public concern on matters of environmental quality.

During the second quarter of the program, a continuation of the previous activities led to evaluating the portable cutting torch under development for use by fire departments by the United Technology Corporation. Also, the citizens' Environmental Quality Committee (presently called Environmental Communications Network) is currently experimenting with their effectiveness in identifying community environmental problems, disseminating factual information about the issue, and organizing citizens' support to correct the situation. Current problem areas deal with open space planning transportation systems, and bicycle path programs.

The Environmental Communications Network is now operating as an information exchange group, with no direct involvement of the 4-Cities Program. They are considering steps to convert the network into a citizens' committee on Environmental Quality Development with some official status.

Since mid-September activities have been primarily aimed at developing a list of potential projects for consideration. Preliminary evaluations have revealed potential study topics in the areas of resource recovery studies for solid waste management, planning for 2-way use of cable TV systems, and various management tools for control and coordination of internal data flow.

C. PASADENA/SPACE-GENERAL

In the early part of the program in Pasadena, the Advisor spent most of his time on an exchange of information with city department heads to become knowledgeable of city operational methods. It was quickly identified that a significant applicability of aerospace technology would be in Management Systems as opposed to material or hardware items. Projects underway in the first three months in which the advisor was either assigned or otherwise initiated were police heliport site selection, graphic aids evaluation, and introduction of a Management by Objectives system. During the first quarter, a number of potential projects were determined. These were helicopter photographs (mapping, event coverage, etc.), data storage and retrieval (records date back over 50 years), future power sources (electrical), communication (with community using, e.g., graphic aids), and housing authority procedures (needs a workable system).

Initial results were twofold. First, an evaluation of various graphic aids material systems (such as 3M System, Technifax "Diazochrome," Agfa Transparex) for viewgraph transparencies led to a cost-effective approach for city management (Transparex System). Second, an evaluation in helicopter site selection using parameters of patrol value, effectiveness with present operations, improvement in using a Pasadena site, and other selection considerations, led to a recommended site. The police helicopter site selection resulted in a final report by the Pasadena Police Department indicating that the real basis for the need of a Police heliport within city limits is the objective of achieving performance effectiveness of 90% as opposed to less than 50%.

The second quarter focused on the "Management by Objectives" (MBO) Program with application to city government. It is believed that the MBO concept will have a significant influence on the effectiveness of day-to-day city operations.

In addition, assistance was given to the Fire Department in relocating fire stations and a plan was developed and is being cycled through the Planning Commission for adoption.

During the third and fourth quarters efforts were predominantly involved in management systems support.

MBO planning and follow-up reviews, seminars for the first-line supervision and support to management development activities were among the major activities. The concepts and methods being employed in MBO have been introduced to more than three hundred personnel in the management organization of the City. An MBO notebook was prepared and distributed to all department heads and division chiefs to assist them in organization of their guidelines, objectives, planning, commitments and reference data, which are being distributed periodically.

Additional support was given to the Police Department in regards to the heliport site selection which resulted in approval of a site by the Board of Directors. Plans are now being developed by the Community Development and Public Works Department for use in submitting an application to the California Department of Aeronautics. Consultation support will be continued in this area through completion of heliport development. Assistance was also given to the Police Chief in a presentation to the Board of Directors substantiating the need for fourteen additional Police officers for which approval was obtained.

Participation was continued in the management seminars held semi-annually for department heads and division chiefs. These efforts include program selection, material preparation and assistance in conduct of meetings.

Data on hardware items, which might have applicability to city needs, have been given to appropriate department heads. These data were obtained from the Urban Technology Conference (San Francisco, July 1972), Public Technology, Inc., and the ASPA Standing Committee on Science and Technology in Government.

D. SAN JOSE/LMSC

The first quarter of the program included many interviews with city personnel. A series of Lockheed seminars was set up for the city department

heads. Some of the assignments immediately given to the Advisor by the City Manager were (1) determine the assignment of priorities to different city projects, (2) develop a municipal information system, (3) prepare an action plan for smog alerts, (4) prepare a plan for implementing a noise control ordinance, (5) analyze vehicle replacement policies and optimize according to economic considerations.

The second quarter included organizing an intern program from Stanford University and San Jose State College as well as promoting new projects. Some of the projects completed from both the first and second quarters were (1) a plan for implementing the noise control ordinance (submitted to the City Council) with a recommendation that noise contours of the city next be developed, (2) a study for optimum vehicle replacement, and (3) a preliminary analysis for an information system to meet the needs of the Office of Intergovernmental Affairs for control and coordination.

Work in progress during the second quarter included (1) a continuation of the seminar series which brings technical personnel from Lockheed to the city to acquaint city personnel with new techniques, (2) further developing of a methodology for assigning development of a municipal information system (MIS) using available software programs and based on a long-term master plan generated by the needs of each department. To implement the MIS, an electronic data processing (EDP) Steering Committee was formed. The Advisor is the chairman of the committee and members are from the various departments of the city.

During the third quarter, an RFP was sent to forty firms, bids were received and evaluated, and a consultant selected to lead the EDP Study. Training programs for department heads and City personnel who will work on the EDP Study were prepared and presented by Lockheed personnel. The weekly seminar program was concluded; interest and attendance grew as the program continued. It is planned to present another series in the Winter of 1972-73. Work on an urban model to facilitate planning has increased; as a preliminary attempt at gaining insight into model function, the Forrester "Urban Dynamics" model will be exercised on the San Jose State College Computer.

After extensive interviews and review of work projects, two interns from the Stanford Business School were placed in a City office to assist full-time for a three-month period.

The fourth quarter saw increasing participation as a consultant on such subjects as the "911" Emergency System, a police record system, a noise control ordinance, and others. Work has begun on analyzing and coordinating educational programs in the City as well as on the establishment of a Community Analysis Staff of volunteers. The Urban Modeling project continued with the development of baseline data to exercise the model.

The Stanford Intern project concluded successfully and another is planned to take place during the 1972-1973 school year. It will differ in that teams of students, guided by a faculty member, will work part-time, principally at the University, on selected problems.

SECTION V

EVALUATION OF PROGRAM TO DATE

As stated in the proposal for this project, the specific objectives of this pilot project are:

- 1) Determine the ability of industrial aerospace professionals to contribute directly in the environment of the cities at the city manager staff level.
- 2) Determine the nature and amount of technical support required to implement a program to bring aerospace technology to local governments.
- 3) Expose city personnel to the "systems approach" and thereby enhance their performance through this educational process.
- 4) Expose aerospace personnel to the sociopolitical process in the cities to enhance their understanding of the cities' problems.
- 5) Assess the applicability of aerospace technology and expertise to problems of the cities.
- 6) Evaluate whether or not this type of arrangement is beneficial to the cities and the aerospace industrial community.

In addition to this list of objectives, specific evaluation criteria from both a programmatic and personal standpoint were identified in the proposal. Although the evaluation is necessarily incomplete at this point in time, the following interim assessment is made of the progress in meeting the above six objectives.

Supplementary information that is relevant to program evaluation is provided in Appendixes A and B.

A. OBJECTIVE 1

Without exception, representatives of the four cities have indicated that the Science and Technology Advisors have contributed significantly to the technical aspects of operations. It is believed that some of the cities may make the

Science and Technology Advisor a permanent position within their organizations following the completion of the program. The success of the Pasadena advisor in implementing the Management by Objectives Task is only one of several examples of the ability of aerospace professionals to contribute at the city manager's staff level. It is believed that the intent of Objective One has already been satisfied.

B. OBJECTIVE 2

There have been varying degrees of support sought and obtained by the Science and Technology Advisor from the parent companies and JPL.

1. Anaheim

The Northrop Corporation has aided in studying the use of infrared imaging devices for fire and police department operational uses. Such devices would aid in "seeing" through smoke and in locating the seat of fires under adverse viewing situations. JPL is currently assisting Anaheim by attempting to promulgate the use of infrared imaging devices for operational deployment tests by all cities of the Four-Cities program. JPL has provided a technical consultant to the Science and Technology Advisor relative to development of a city ordinance for a cable TV system and provided consultation in Source Evaluation Board procedures for CATV. JPL has also described a technique for evaluating the effectiveness of police helicopter patrols, and provided support for an emergency communications, command, and control system for the city.

2. Fresno

TRW Systems has provided support to the Fresno Community Analysis Division in development of models and community data analysis techniques, partly under contract and partly at the expense of the company. Information was also obtained relative to consideration in converting the city fleet to LPG.

JPL has provided support in the areas of (1) evaluation of the conversion of the city fleet to LPG, (2) evaluation of solid waste management approaches

(3) computerization of a vehicle replacement model, and (4) provision of reports such as the police helicopter effectiveness analysis performed with the Los Angeles Police Department.

For the second year of the Four-Cities program at Fresno, TRW has been replaced by La Jolla Research, a subsidiary of Science Applications, Inc. JPL participated in the selection of the company and in interviewing the candidate Science and Technology advisors.

JPL has provided support to Fresno in furnishing documents dealing with solid waste disposal and has provided a literature search for data systems as applied to urban requirements.

3. Pasadena

Space-General Corporation has conducted a continuing series of seminars instructing approximately 300 management personnel from within the City of Pasadena on the Management by Objectives system.

JPL has conducted a field acoustical survey relative to the level of helicopter noise in the vicinity of a temporary police helicopter refueling site.

Although not done at the request of Pasadena, JPL has used Pasadena demographic data to develop a site location model potentially useful in siting recreation areas, fire stations and the like.

4. San Jose

Lockheed Missiles and Space Company has supported their Science and Technology Advisor by (1) assisting in the review and evaluation of potential project priority ordering techniques, (2) developing and presenting a series of seminars on subjects ranging from such esoteric systems as lasers to such things as forms design; other topics presented to date include new energy systems, the systems approach, and interactive computer-based equipment inventory control, (3) use of the LMSC technical laboratory personnel relative to the need

for reliable, easier-to-install-and-maintain devices for detecting and transmitting traffic flow.

In addition, the Science and Technology advisor has developed a working relationship with the Stanford Business School to assign interns to work on specific activities. Two specific activities underway are (1) evaluation of downtown projects and (2) analyzing vehicle replacement policies.

JPL support has been in the distribution of documents and preliminary efforts for JPL to provide consultative support in the area of cost/benefit analysis for data systems is underway.

An emergent factor from the summary of technical support activities is that a single individual within the city is not a viable approach. He must be provided with appropriate resources to augment and complement his own background in order to fully contribute to city technological problem solutions.

C. OBJECTIVE 3

In general, all cities have indicated that the "way of thinking" represented by the aerospace professional has contributed to city operations. Three specific situations wherein the systems approach is expected to enhance operations are (1) Anaheim - development of a specification for complete usage of cable TV within the city, (2) Pasadena - introduction of the Management by Objectives management approach utilized so successfully within the aerospace industry, and (3) San Jose - formulation of a phased plan involving city personnel in the development of an RFP for a municipal information system. Although these examples may seem straightforward, they represent changes in the way the city is doing business as a result of the introduction of the project. These examples are believed to indicate the ability of the "systems approach" to significantly enhance city performance.

D. OBJECTIVE 4

The orientation period has led the Science and Technology advisors personally to encounter such obstacles as (1) certain old-line bureau chiefs are not receptive to "outside" technical assistance; in fact, some do not accept the line management structure existing within the City. (2) The "real world," or irate local residents, may overwhelm the clear technical arguments to improve the effectiveness of police helicopter operations by a local refueling site (Pasadena), (3) the development of community support and evaluation for a proposed project is very time-consuming and requires a great deal of personal involvement (Fresno), and (4) relocation of a fire station may enkindle programs for those who "lose their station" and those who "don't want one in their neighborhood." (5) Obtaining funding for developmental hardware tests or other City research and advanced development activities. These examples typify some of the objective encounters that the Science and Technology Advisors are experiencing in dealing with the public sector. In general, however, the Advisors have been well received by the city staff personnel. The aerospace professionals are learning how to work effectively in the city environment; however, it is a time-consuming process to develop the trust relationships necessary to make a project of this type effective.

E. OBJECTIVE 5

To date, there have been only a few instances of direct application of aerospace hardware technology to problems of the cities. It is generally believed that the "greatest applicability of aerospace technology" will be found in the area of management techniques or systems engineering as opposed to hardware per se. The value of such intangibles is, recognizably, difficult to validate. Nevertheless, specific technology applications include:

- 1) Thermal imaging (IR technology) for viewing through smoke or locating the seat of a fire.
- 2) Rocket torch cutting device for emergency situations.
- 3) Use of noise monitoring equipment.
- 4) Fire department closed cycle breathing apparatus.

- 5) Helicopter mapping.
- 6) Design of emergency communications, command and control systems.
- 7) Systems studies of CATV, City command/control functions, and Municipal Information Systems.
- 8) Introduction of Management by Objectives.

The question of whether a technology is "aerospace" or not can usually be raised in conjunction with many, if not most, technologies. The fact remains, however, that the aerospace professional, as a technical trained person, is capable of discovering even "non-aerospace" technologies and to evaluate their relevance to city needs. An example of this is in San Jose where advanced educational communication techniques are being studied by the Science and Technology Advisor to determine applicability to San Jose City personnel training activities. It is immaterial whether this is considered "aerospace" technology or "education" technology; the point is that the on-site aerospace professional can uncover, comprehend, and evaluate the technical complexities of the proposed systems and ultimately make appropriate recommendations.

F. OBJECTIVE 6

Two city managers have at least tentatively indicated that they would like to continue the program beyond the two-year demonstration period, perhaps even with city funds. All four cities strongly support the intent of the project and progress to date. The final importance of the program hinges on the ability to clearly demonstrate to the respective City Councils and citizens of each of the four cities that the project is meaningful and valuable to them.

It is perhaps still too early to determine whether or not aerospace corporations will benefit significantly from the program. There have been indications from some companies that they are considering this sort of program in a long-term, new business sense. From a negative point of view, only one company has chosen not to renew the second-year contracts and in this instance the pivotal reason may have been the personal desire of the advisor more so than a reflection of overt company position.

APPENDIX A

AEROSPACE INDUSTRY TECHNOLOGY TRANSFER

Gilbert Brighthouse

10/9/72 .

PURPOSE: To study the phenomena of technology transfer, and what facilitates or inhibits the process. This portion of the evaluation is not concerned with the value of the products of the transfer, but is a study of the process.

METHODOLOGY: The major emphasis is on interviews, carried out periodically throughout the study. Those interviewed include:

- 1) City Advisors.
- 2) City Personnel, elected, appointed and Civil Service.
- 3) Randomly selected citizens.

Samples of the kinds of data sought in these interviews are shown in Exhibits 1 and 2. In the non-directive climate of these interviews, most of the respondents speak so freely that it is unnecessary to prompt them with questions, but if they fail to talk about one or more of the areas shown in Exhibits 1 and 2, open-end questions are asked.

In addition to the interviews, other sources of data include:

- 1) Questionnaires to be sent to all city officers approximately 18 months after the start of the project.
- 2) Observations of each city and its characteristic culture, derived both from tours on foot, via public transportation, and by private automobile, and through library and newspaper research.

Some ideas of the nature of these observations may be obtained from the following preliminary findings:

GEOGRAPHIC FACTORS:

Fresno is unique among the four cities in that it is separated by more than 200 miles from any larger metropolis. Each of the other three cities is strongly influenced by larger neighbors. San Jose is part of the larger Bay Area megapolopolis, and both Pasadena and Anaheim tend to regard themselves as suburbs of Los Angeles. Theoretically, this should make the process of transfer somewhat easier in Fresno, if it were not for the operation of some other factors.

A significant aspect of the geography of Pasadena is that it is completely hemmed in on all four sides and cannot expand its boundaries. Anaheim has only one direction in which it can grow, whereas both San Jose and Fresno are better able to expand their areas as needs develop.

ARCHITECTURE:

The process of interfacing between the City Advisor and the city personnel is profoundly affected by the architecture and furnishings. San Jose is particularly fortunate in this regard in that the City Advisor has his office in the City Manager's suite, in a handsome, modern building which also houses the majority of the city departments. This means that the Advisor is easily able to interface with city personnel on many levels on an informal basis.

In Pasadena, the Advisor has a small private office on the ground floor of an old, but still attractive, City Hall. The Mayor, City Directors, City Manager and his staff are on the second floor, and most of the major departments are in the same building. The Police Chief, however, with whom the Advisor has frequent contact, has his headquarters several blocks away.

The Pasadena situation, therefore, is not quite so convenient as that at San Jose, but it is considerably better than in the other two cities.

In Anaheim, the City Advisor has a small, semi-private office in the Administrative Analyst's suite in an old and badly outworn City Hall.

The architectural situation is poorest of all in Fresno. Although the City Hall is a very attractive and modern building, it is badly overcrowded. For the first six months of the study, the Advisor had a desk in a tiny office into which three other people were also crammed. Privacy was nonexistent, and concentration was very difficult. For the second six month period, the Advisor had more usable office space, but unfortunately it was located in an outlying building which was at least 15 minutes away from City Hall, and from most other city departments. This meant that interfacing was more difficult and often more formal. For the second year of the Fresno program, the Advisor will reside with the Fresno Community Analysis Division in City Hall.

POLITICAL AND CULTURAL CLIMATES:

Voting records show a strongly conservative trend in Anaheim, somewhat more mixed patterns in Pasadena and Fresno, and relatively more liberal positions in San Jose. While the residents of each cover a broad spectrum, expressions of conservative opinion are heard most often in Anaheim, and less often in San Jose.

Pride in facilities for higher education varies considerably. When asked about the availability of college and university training, most Pasadena residents immediately cite the world-renowned California Institute of Technology, as well as several other less well-known colleges. Residents of San Jose speak with pride of the California State University at San Jose, and frequently mention, also, Stanford University -- "Almost in our back yard." In addition, San Jose has close by Santa Clara University, and other small, but reputable, institutions.

Among academicians, the California State University at Fresno enjoys a good reputation, but relatively few citizens of Fresno seem to identify with this university. Anaheim has no major institution of higher education within its boundaries. In the adjoining city of Fullerton, there is a well-regarded California State University, but Anaheim residents who have been interviewed do not seem to regard this as their institution.

Good public libraries, lectures and concerts are available in each of the four cities. However, Pasadena and San Jose are outstanding in these respects.

CITY GOVERNMENTS:

The Mayors of three of the cities have had little or no involvement with the project. On the other hand, the Mayor of San Jose, Mr. Norman Y Mineta, has taken a very helpful interest in the project there. On September 28, 1972, he wrote to this Investigator as follows:

"Mr. Weiss' work here is effective in several ways; it has had an impact on our vehicle replacement policy, which has probably saved considerable expense. It represents technical skills which are not resident in the City Staff, but are now more visibly needed for city plans and services. It promises some innovations in city services, and it is helping to realize some needed review of city operations and the use of Electronic Data Processing.

The success to date which, I believe, is considerable, is attributable to several factors, principally to the length of the project. Short appointments of three to six months do not leave the time to learn enough about city operations and, more important, gain acceptance by city personnel. Mr. Weiss appears to have realized the vital character of these elements, and has not tried to impose 'aerospace expertness', stressing instead the development of a good rapport with city personnel. In addition, Mr. Weiss' own broad interests and capabilities have been positive influences.

The factors operating to inhibit performance are those which may be expected in private enterprise, as well as

government. There was, and still is, a negative view of outsiders who are newcomers, resistance to change in general, and an amorphous fear of technology and job displacement. "

Each of the four cities has a City Manager. There is naturally some variability in his stability in the community.

Compared with the other three cities, San Jose is considerably more understaffed. In consequence, most city people there are working very hard, and many of them feel unappreciated by the public. City taxes in San Jose are relatively lower.

There is another element which has aided the process of technology transfer in San Jose: This is the fact that within the last five years, many members of city government, and many citizens were involved in the development of a set of goals for their city. The process of listening to many individuals and drawing together a series of comprehensive reports has undoubtedly made the cultural climate more receptive than it would otherwise have been.

Similarly, the City of Pasadena is currently starting a program for developing goals, but so far, there has been little citizen involvement.

COMPANY INVOLVEMENT:

This factor varies considerably from city to city. In the case of Fresno, the TRW Co. had been involved for several years in some consulting operations with the city. However, since this project began, the company has given little time or attention to the project. One factor has been the separation by some 200 miles between company headquarters and the City of Fresno. Secondly, TRW had expressed a desire to get out of local government projects. Third, TRW adopted a cost control system which requires their employees to charge their time to particular projects. This has made it difficult for the City Advisor to get his colleagues to spare unbudgeted time for Fresno. This relationship ended July 1, 1972, with the expiration of the contract between the Jet Propulsion Laboratory and TRW.

The Anaheim Project has had little involvement by the Northrop Corporation.

The Aerojet Co. has given considerable assistance to Pasadena and its City Advisor. This help has been particularly important in the training of key people in Management by Objectives.

Similarly, the Lockheed Missiles & Space Co. has given a great deal of support to the City Advisor in San Jose, most noticeably in providing seminar leaders for city staff meetings, but in various other ways as well. It is notable that the San Jose City Manager is in contact at least once a week with the man to whom he reports at the company. In addition, Lockheed management men have been particularly faithful in attendance at the 4-Cities Quarterly Review Meetings.

PERSONAL ATTRIBUTES:

Each of the City Advisors displays characteristics which, while quite different, all contribute to the success of the technology transfer. In San Jose, the City Advisor is Jerry Weiss. Among his strengths are education, both as an undergraduate, and as a postgraduate student, in mathematics, physics and psychology. Before the project began, he had been actively involved in information systems research, and as a citizen, he had been in close contact with local government in Mountain View -- a city which is a near neighbor of San Jose. In addition, he is a vigorous, aggressive man, with a triple sec sense of humor.

The City Advisor to Fresno for the first year of the project, Jim Wakeman, in addition, to engineering, had been deeply involved in local politics in the Redondo Beach area before the project started. When he began work with the City, he moved his family to Fresno, and became actively involved as a local resident. He has a deep interest in ecology, and a crusading spirit.

In Pasadena, Forrest Warren, the City Advisor, has the advantages of being quiet, non-threatening, winning friends by his gentle ways. And, in Anaheim, Bill Armstrong combines a very quick mind and high energy level with an eager desire to be helpful.

INTER-CITY COLLABORATION:

In recent months, a noteworthy development has been the sharing of experiences and ideas among the four City Advisors. It is anticipated that this process will become more fruitful in the second year of the program.

EXHIBIT 1

AEROSPACE INDUSTRY TECHNOLOGY TRANSFER

Questions asked of City Advisors:

BIOGRAPHICAL QUESTIONS:

Birthdate; birthplace; marital status; family; education; work experience, including "Which parts of your work experience have been most satisfying to you? Why?"

QUESTIONS REGARDING THE COMPANY:

"What were you doing for the company just before you received this assignment?"

"How did you get picked for this assignment?"

"How would you describe the culture of your company?"

"How would you describe the characteristic leadership styles in your company?"

"Have there been any particular developments in the company which might affect this project?"

"What experience has your company had in technology transfer?"

"How much is your company involved in this particular project? "

"Would you like to see more or less company involvement? "

"Is there anything that the company could do now that would help this Project? "

QUESTIONS REGARDING THE CITY:

"How do you feel about your physical arrangements? "

"How would you describe the special characteristics of this city? "

"What has the city done to facilitate your task? "

"What frustrations have you encountered? "

"How would you describe your relations with the City Manager? With his Deputy and other assistants? With the Mayor and the Council? With the department heads? "

"What have been your most rewarding experiences so far on this project? "

"Is there anything more that you would like to add about your city management? "

"To what degree have you become involved with other institutions besides the City Government - Colleges? Clubs? Churches, etc.? "

"What have these involvements done to influence the project? "

QUESTIONS ABOUT THE ADVISOR HIMSELF:

"What is there about you which helps you to help the City? "

"What might there be about you which hinders the process of technology transfer? "

"How has this assignment changed your thinking? "

"How has this assignment changed the way you live? "

"What effects has this assignment had on your family? "

"Can you tell me about your hopes for this assignment? "

"Can you tell me about your aspirations after this assignment is completed? "

"What suggestions can you add for any possible future attempts to effect technology transfer from industry to City Government? "

"Is there anything further you would like to add? "

EXHIBIT 2

AEROSPACE INDUSTRY TECHNOLOGY TRANSFER

QUESTIONS ASKED CITY MANAGERS, THEIR DEPUTIES AND ASSISTANTS:

"How do you feel this project is developing? "

"Have you seen any significant incidents or achievements? "

"Are you aware of any difficulties which might interfere with this project? "

"What are the special characteristics of this city? "

"How does this project differ from other situations in which the city uses consultants? "

"To what degree does this project involve other institutions in the community -- colleges? clubs? churches? other? What have been the effects of these involvements on the development of the project? "

"How do most of the people in city management feel about the Advisor? "

"What has the Advisor done that particularly helped the project along? "

"What kinds of things could the Advisor do to make the project more effective? "

"What would you say are the Advisor's greatest strengths? "

"What kinds of things could the city do to make the project most effective? "

"What kinds of things could the Advisor's company do to make the project most effective? "

"What suggestions can you make for any possible future attempts to effect technology transfer from industry to city government? "

"Are there any other points you would like to add? "

APPENDIX B

A POSSIBLE METHOD FOR PROGRAMMATIC EVALUATION OF THE FOUR CITIES PROGRAM

B. Mednick

8/4/72

I. THE PROBLEM

The Four Cities Program is progressing with a general feeling of success by most parties involved. The degree of success is uncertain. There is a need for a quantitative rule to evaluate the program as suggested in JPL proposal 650-127 dated February 22, 1971. Such a numerical indicator could be used by the cities, NSF and the aerospace companies to measure the program's success and to point out deficiencies.

The method described in this appendix is only one possible evaluation method. It should not be construed as the final evaluation method that will be used. It is included here only for completeness in documenting JPL activities in conjunction with the Four Cities Program.

II. GENERAL INDICATORS

The presence of the Science and Technology Advisor can only be beneficial to the cities. A negative effect is unlikely due to the manner in which the advisors were selected and their mode of operation. The city governments request assistance on various projects. If the advisor's suggestions are deemed unwise, then they are not implemented, and nothing is lost.

One general indication of success is the cities' propensity to replace the advisor at their own expense after completion of the program under joint NSF/NASA funds. If the city officials feel a need for such an advisor exists, then obviously the advisor has made a positive contribution (in their judgement).

Failure to maintain the position may indicate that the city officials feel the results do not offset the costs.

III. A SUGGESTED RULE

The rule consists of the pertinent criteria shown in Table B-1. The given values are maximums and the methodology for assigning value are stated later. Note that the values differ depending on the frame of reference. City involvement and transferability are most important to the NSF/NASA sponsors, whereas impact and savings are the principal concerns of the city. The rule may be applied to each task or to the city as a whole. If each task is evaluated separately, the average is not a good measure of success. Some tasks are far more important than others. Also, one highly successful project combined with one unsuccessful project presents a different picture than two projects with mediocre results.

The rule is simple to apply and, hopefully, is unbiased. But there are two important shortcomings. Political circumstances play a major role in the operation of civil governments. It is possible for politics to interfere with the success of any task. If such conditions exist, they should be noted as a footnote in the evaluation. Secondly, the rule only takes into consideration the projects which were performed. Problems which were not approached are not included. However, a failure to deal with important problems is often a shortcoming of civil governments. This could cause a failure in any given task as well.

IV. PRELIMINARY ASSIGNMENT OF VALUES

The values assigned here are preliminary estimates. It is expected that use will cause some adjustment in the rating levels, especially in Areas 1 and 7.

1. Cost

For the city as a whole under the NSF/NASA viewpoint, calculate the percentage of the city budget being spent on tasks in the program and award one

Table B-1. Criteria

		Value	
		<u>NSF/NASA Evaluation</u>	<u>City Evaluation</u>
1.	Cost How much is the city investing?	30	10
2.	Transferability Are other cities using it?	20	5
3.	Impact What percentage of the population is affected? What percentage of the departments of the city are affected? Permanence of the change (i. e., physical device) - is it still in use after one year?	15	25
4.	Reaction Did the city manager, department heads and citizens indicate pleasure, or complain?	10	15
5.	Role of advisor Would it have been done without him? How important was his participation?	5	5
6.	Aerospace Involvement Was aerospace technology used? Were aerospace company resources used?	5	5
7.	Savings What is the return per dollar invested?	5	20
8.	Success Did it achieve stated goals?	5	10
9.	Schedule Was it on schedule?	5	5

point for each percent up to the maximum of 30. For the city's viewpoint, divide this by 3. To evaluate each task use the following table.

<u>Cost</u>	<u>NSF/NASA Viewpoint</u>	<u>City Viewpoint</u>
Under \$10,000	0	0
\$10,000 - \$50,000	5	2
\$50,000 - \$100,000	10	4
\$100,000 - \$250,000	15	6
\$250,000 - \$500,000	20	8
\$500,000 - \$1,000,000	25	9
Over \$1,000,000	30	10

2. Transferability

From the city's viewpoint, if another city is using the solution, 5 points; otherwise zero.

From NSF/NASA's viewpoint, if another city is using it, 20 points. If they are preparing to use it, 15 points. If another city asked for information, 5 points.

For the evaluation of the city as a whole, multiply the maximum value by the percentage of projects transferred to other cities.

3. Impact

For both viewpoints:

5 points if still in use after one year.

5 points multiplied by the percentage of city departments affected.

5 points multiplied by the percentage of the population directly affected.

For city evaluation add:

5 points if the solution involves a physical device (i.e., machinery, computer program).

Use 10 points instead of 5 for the population affected.

For overall viewpoint, the values should be average of values for all tasks.

4. Reaction

If any complaints are received, zero points.

No reactions, 5 points.

If praise in writing is received from the city manager, department head or a citizen, maximum number of points.

5. Role of Advisor

If he was in charge of the project or if the project would not have been done without him, 5 points.

6. Aerospace Involvement

5 points if aerospace company personnel or resources were used (besides the advisor) or if the technology employed was unique to the aerospace industry and could not have come from another source.

For the total city, use an average overall task.

7. Savings

<u>Savings per dollar investment</u>	<u>Evaluation</u>	
	<u>NSF/NASA</u>	<u>City</u>
1¢ - 6¢	1	3
6¢ - 8¢	2	5
8¢ - 12¢	3	10
13¢ - 15¢	4	15
Above 15¢	5	20

8. Success

Award the maximum if prestated goals are achieved.

9. Schedule

5 points if completed on time, as decided at start of task.

V. EXAMPLE

Figure 1, Appendix B, contains an example of values awarded at the assumed completion of the stated tasks. Many assumptions were made about the future of the tasks. This is merely an example and the values bear no relevance to the true situation, except by coincidence. The NSF/NASA viewpoint is used in the detailed portion. The city viewpoint is shown as a comparative total. The NSF/NASA evaluation depends greatly on a favorable response and investment by the city. The city is more concerned with major improvements and large savings.

	Cont	Transfer-ability	Impact				Reaction			Advisor Role		Aero Industry		Savings	Success	Schedule	Total	
			% of City Depts.	% of Population	Physical	In Use After Year	C. M.	D. M.	Citizens	In Charge	Responsible	Resources	Technology				NGF/NASA	City
Pasadena																		
MBO	0	0	5	0		0	10			5		0		0	5	5	30	(41)
Heliprot	15	15	1	5		5			0		0	5		2	5	0	53	(51)
Fresno																		
Pyrolysis	30	5	1	5		5			10		5	0		0	5	5	71	(67)
Environment Council	5	0	1	3		5			10		0	0		0	5	5	34	(46)
Anaheim																		
Cable TV	30	20	5	5		5			10		0	5		1	5	0	86	(65)
Stadium	5	0	1	1		5		10			0	0		5	5	5	37	(62)
Infrared Sensor	10	20	1	1		5		10			5		5	5	5	5	72	(85)
San Jose																		
Seminars	0	0	5	0		0		10		5		5		0	5	5	35	(46)
Equipment Repl.	5	5	1	1		5		5			0	5		5	5	5	42	(62)

Fig. 1, Appendix B